

Electric Transmission Issues

Wind and Prairie Task Force

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Access
Capacity
Upgrades

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Transmission Access

- Rate Design for Regional Access
 - License Plate
 - Postage Stamp
 - Charged to the load
- Interconnection Costs
 - FERC Order 2003
 - Repayment of network upgrades
 - Participant Funding

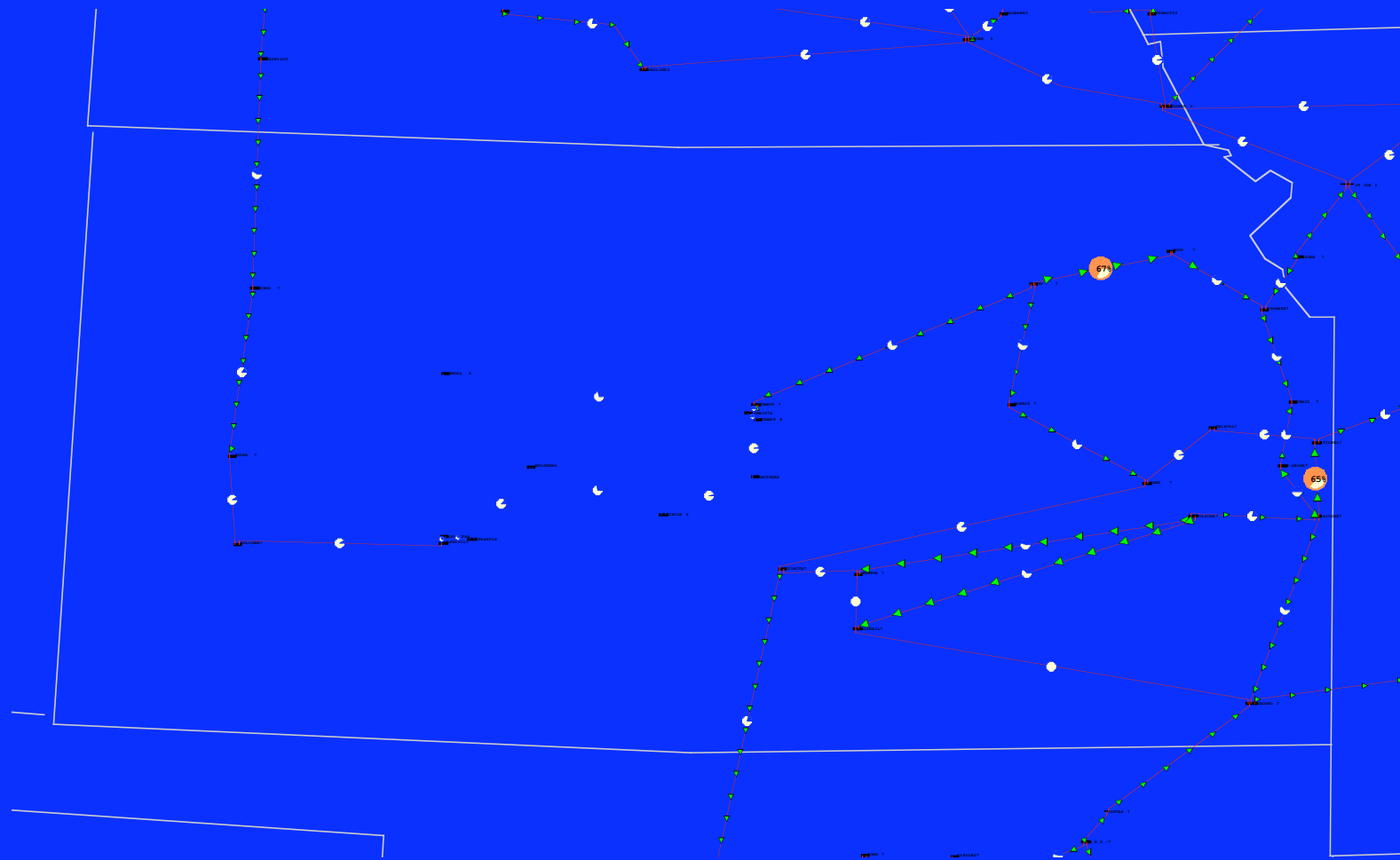
Transmission Capacity

- Transmission system properties
 - It is a grid or a network
 - This is the result of how the system was incrementally built
 - Power flows over the path of least resistance
 - Power flows on the network at any point in time depend on loads (sinks) and generation (sources)
 - Capacity on the system depends on system usage!!

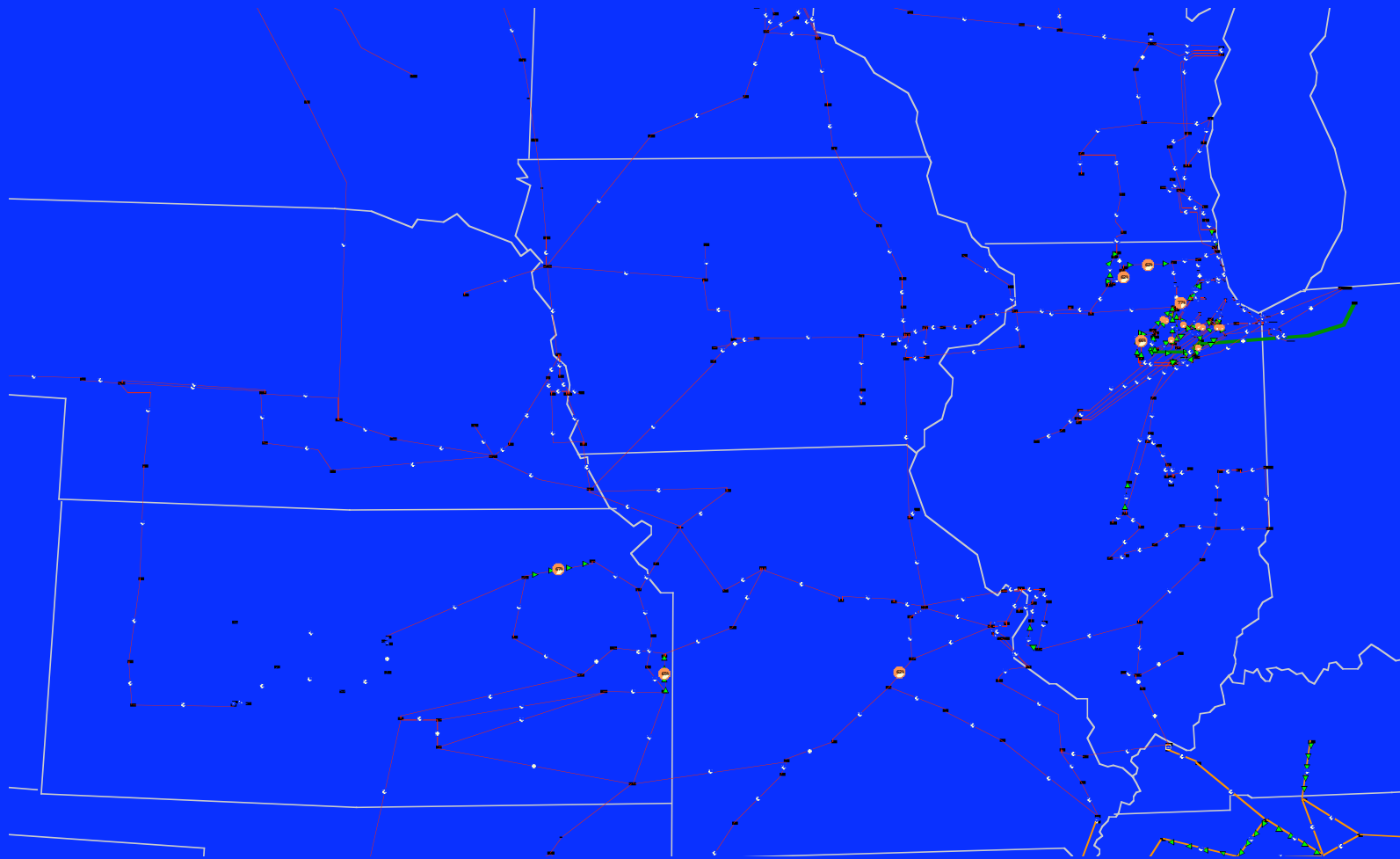
Transmission Capacity Issues

- Loading of individual lines
- Ramp rate limitations
- Limited local markets
- Exports to other markets

High voltage transmission in Kansas



Exports?



Transmission Capacity

- Calculating transmission capacity
 - Must evaluate probable sinks and sources
 - Must assume that system is reliable with one failure
 - Must account for existing transmission rights
 - Certain loads have firm rights for access to generation
 - This in essence means that some generators have a right to operate except in emergency conditions
 - First you must know where the source will be added and where the sink will occur!!
 - Many developers mistakenly think that there is a generic capacity availability number for a given location – there is NOT – it depends on who is using the power, how the generation will be dispatched, and what generation is being displaced!!!
 - This can't be an input into the process but the result of a study

Case-by-case analysis



SPP

*Southwest
Power Pool*

***Feasibility Study for Generation
Interconnection Request***

spp.org

KS Panhandle SPP Meeting

- Wichita, February 17, 2004
 - Looked at increasing capacity for Western Kansas wind and coal generation
- Plans presented
 - Sunflower
 - Aquila
 - Xcel
 - Zilkha
 - Enxco

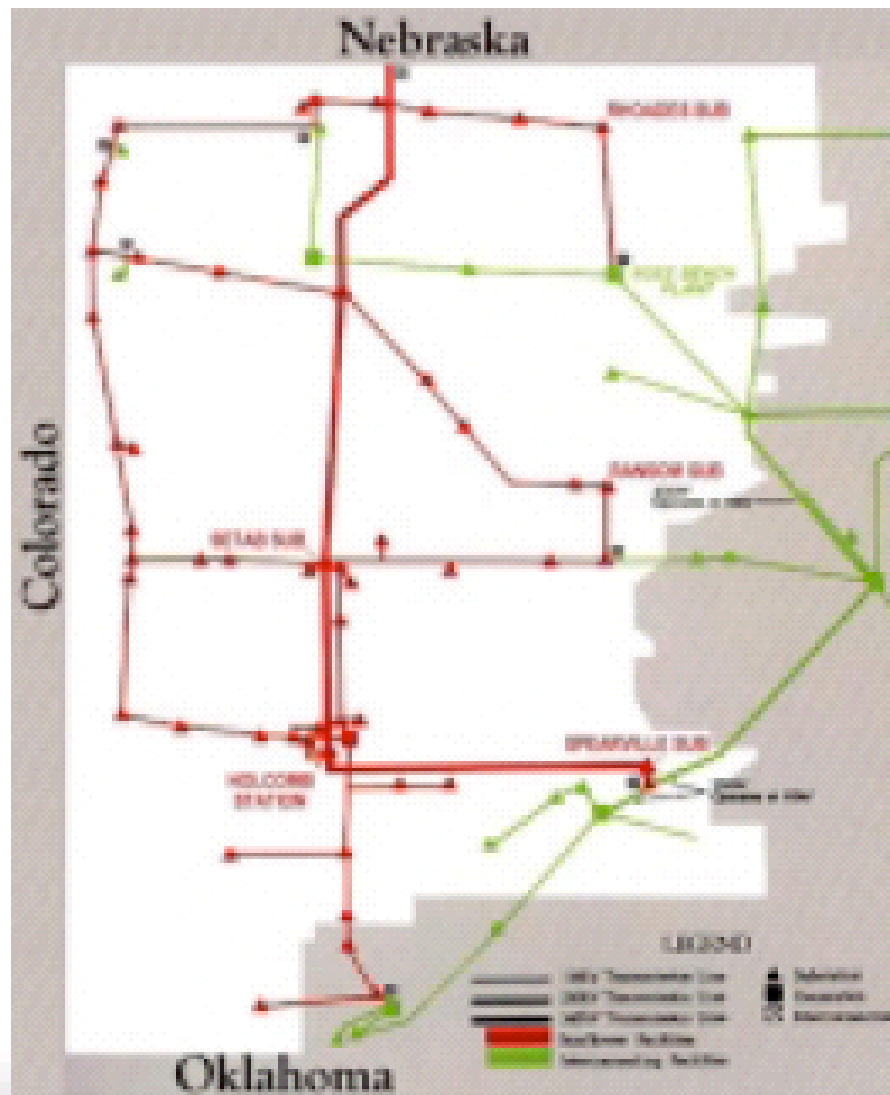


Holcomb is at a 4-way 345 kV Hub





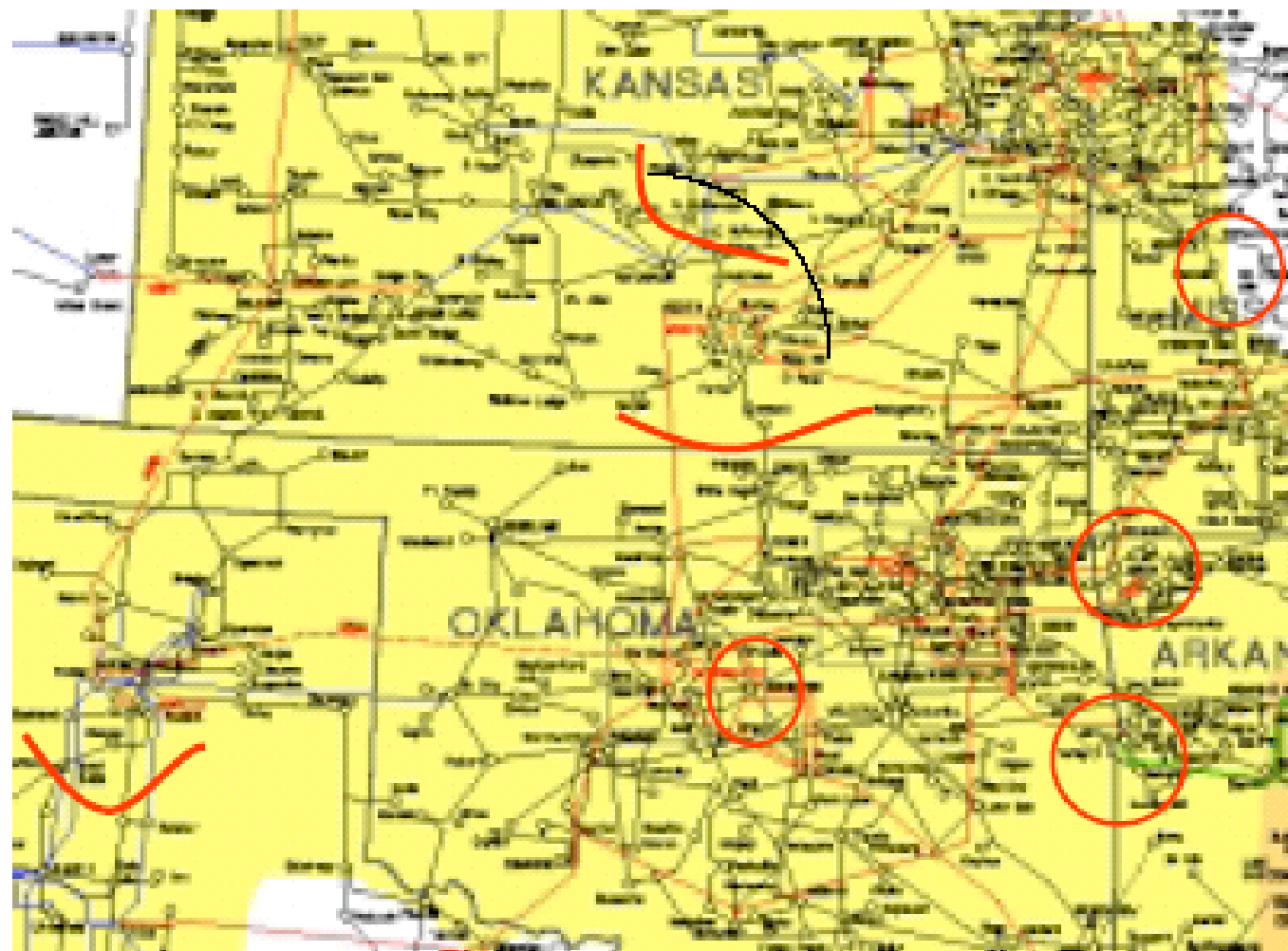
Sunflower's Transmission System



- Sunflower operates 345-kV transmission north and east of the Holcomb power plant.
- At Holcomb, Sunflower ties into the new Xcel 345 kV lines southward to Potter County Substation, near Amarillo and westward to the Lamar AC/DC/AC converter station, now under construction.



SPP North – South Transmission is Constrained & Many “Local” Base-case overloads.

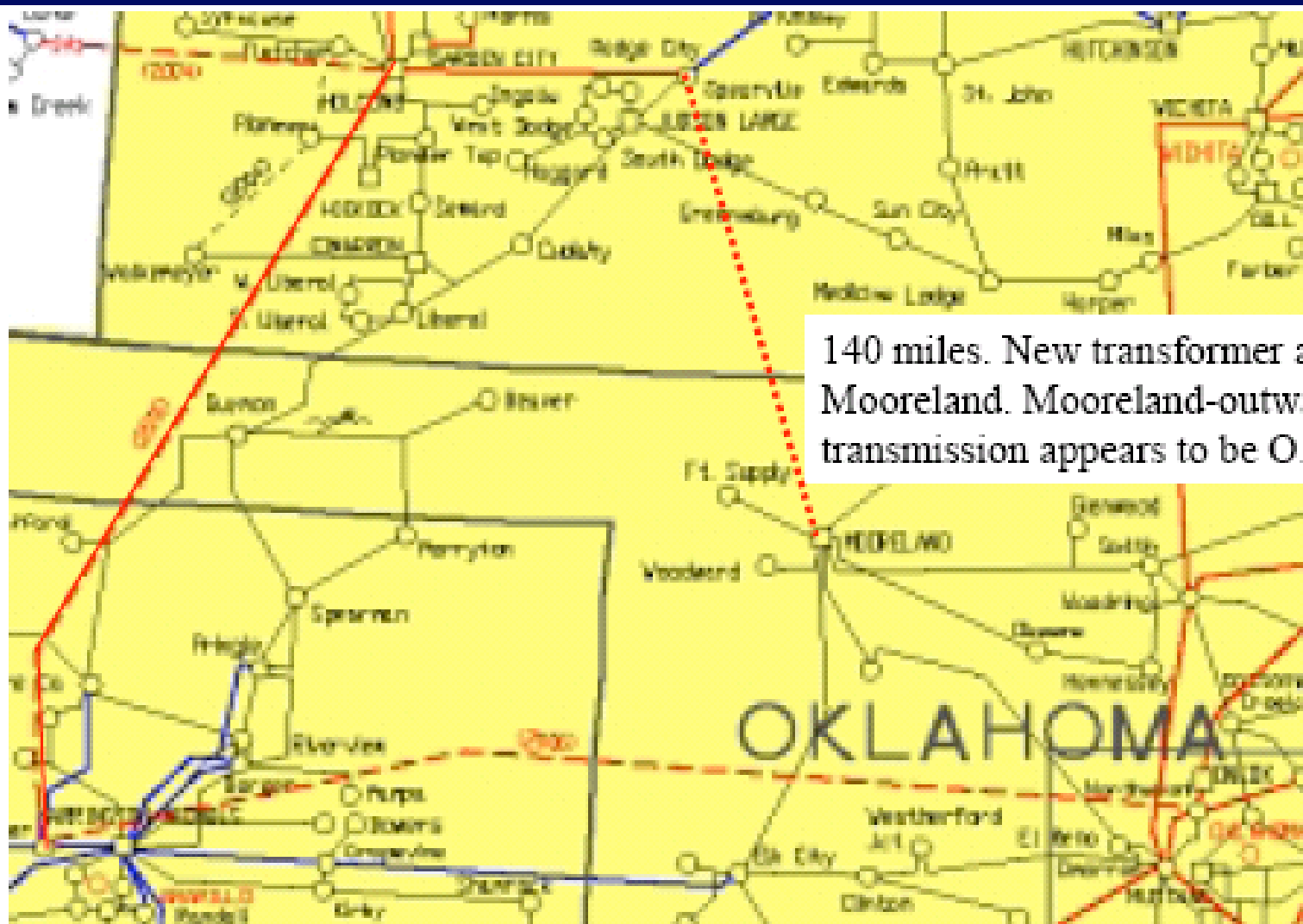


Major Constraints:

- North-South flow across KS into OK and Entergy, e.g. Wichita south 345 kV.
- Jeffrey – southwest problems e.g. McPherson.
- SPS Amarillo – Lubbock stability constraint.
- Localized 115/138 kV problems:
 - Clinton-Osceola
 - Flint Creek – Tonitown
 - Ft. Smith xfmr
 - Horseshoe Lake area



Spearville- Mooreland 345 kV Project

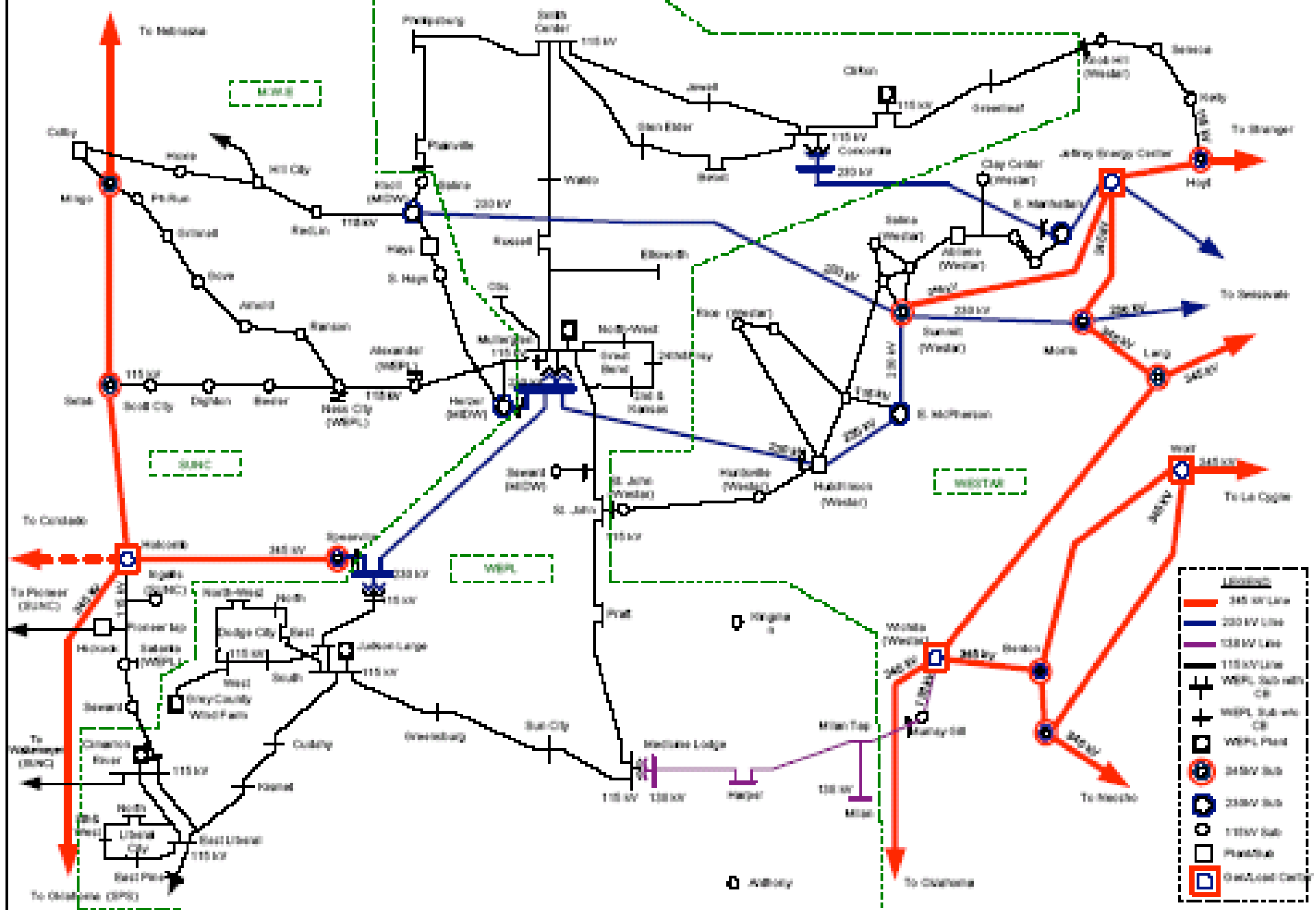




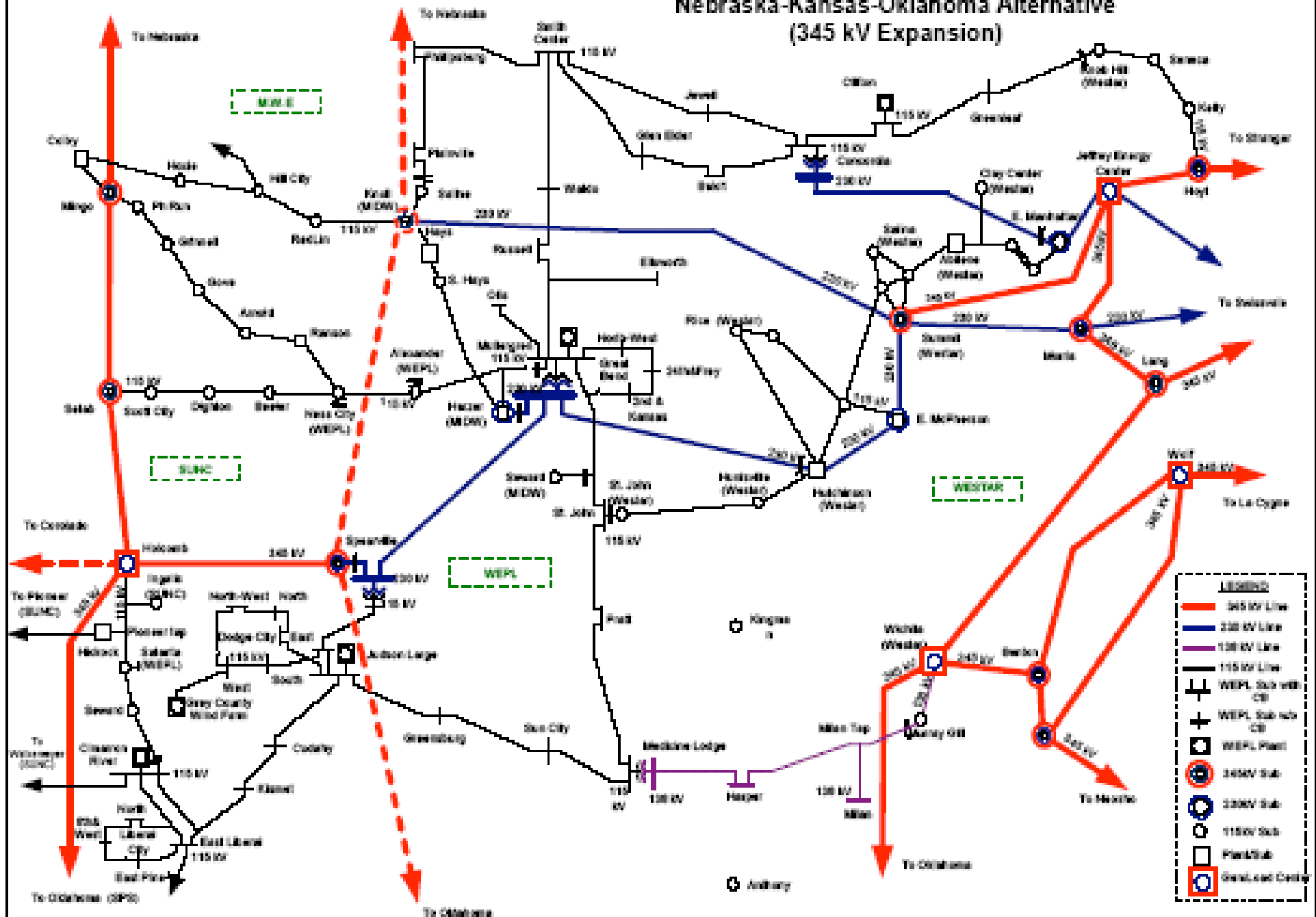
Spearville-Mooreland Facilities

- 345 kV Transmission Line, Spearville-to-Mooreland Substations
 - Line Length: approximately 140 miles. Detailed routing not done.
 - New 345-kV / 138-kV transformer at Mooreland Substation.
 - 2 bundled conductors per phase (954 ACSR Cardinal) 2 shield wires
 - H structure horizontal arrangement
- Terrain is treeless, sparsely-settled farmland, flat to slightly rolling.
- Initial Studies indicate 138-kV capacity from Mooreland outward is probably adequate.
- Estimated costs \$45 - \$55 million.
- Could be in service by mid – 2007 with commitment to move forward.

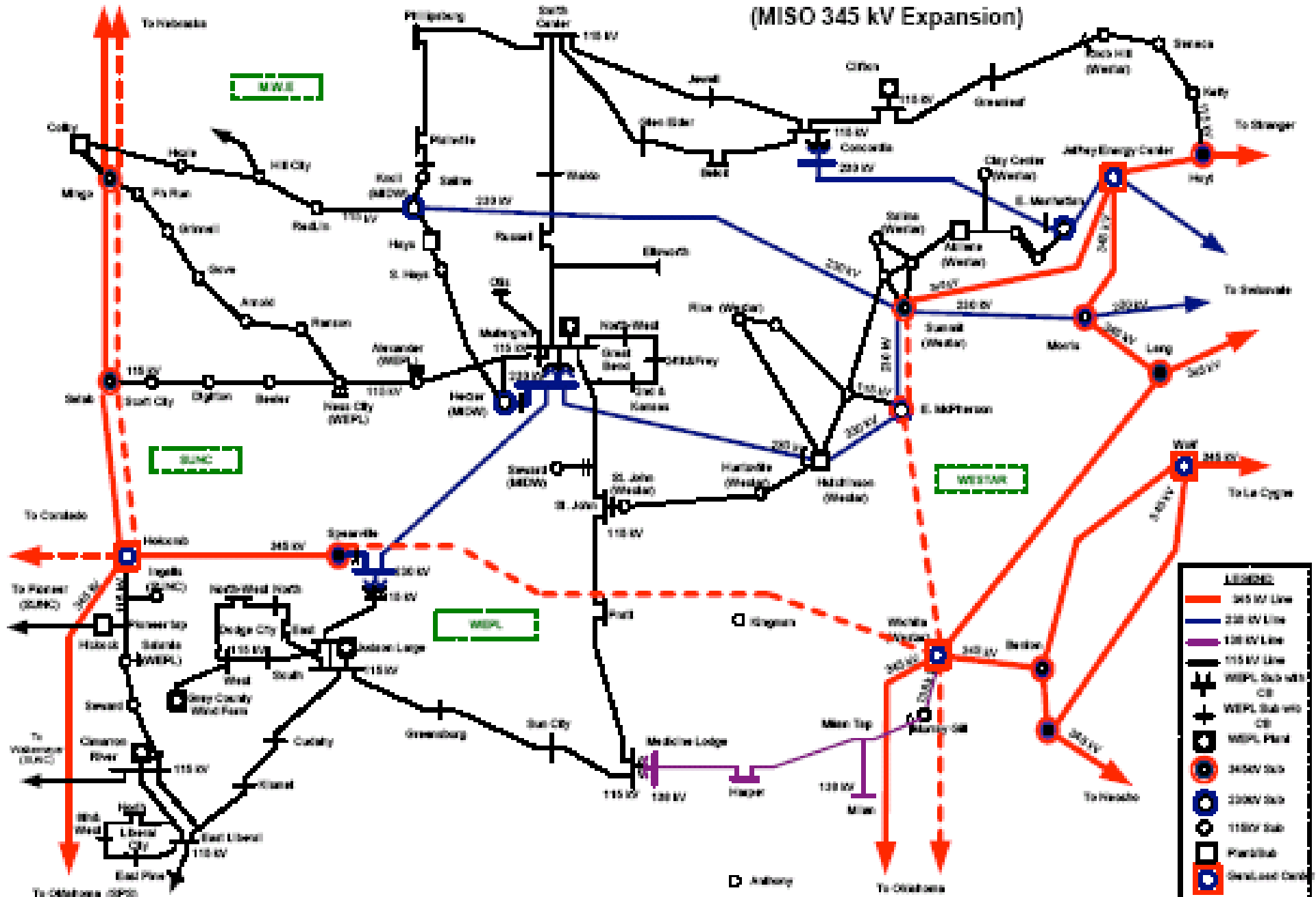
WEPL and Its Vicinity Transmission Systems

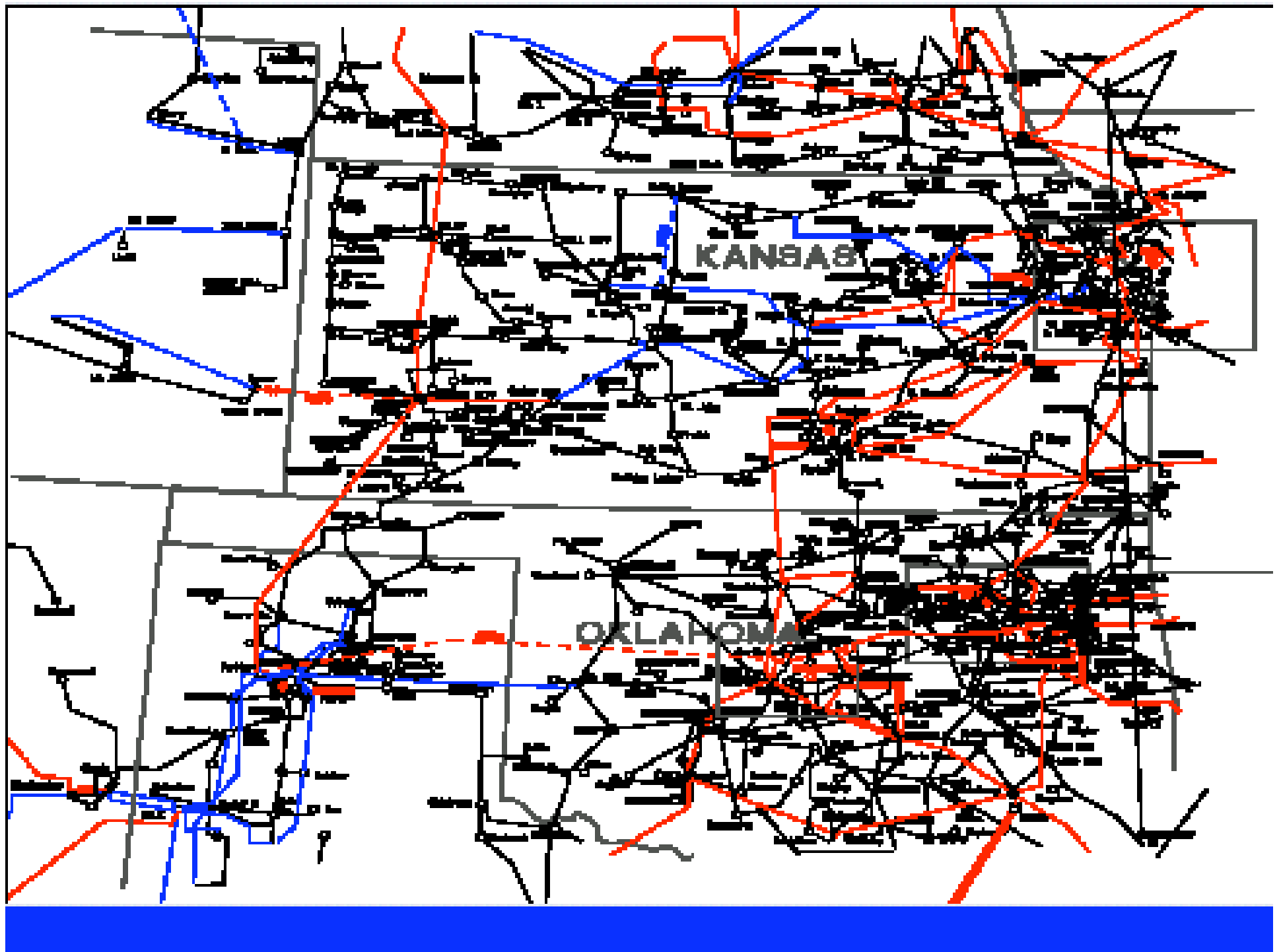


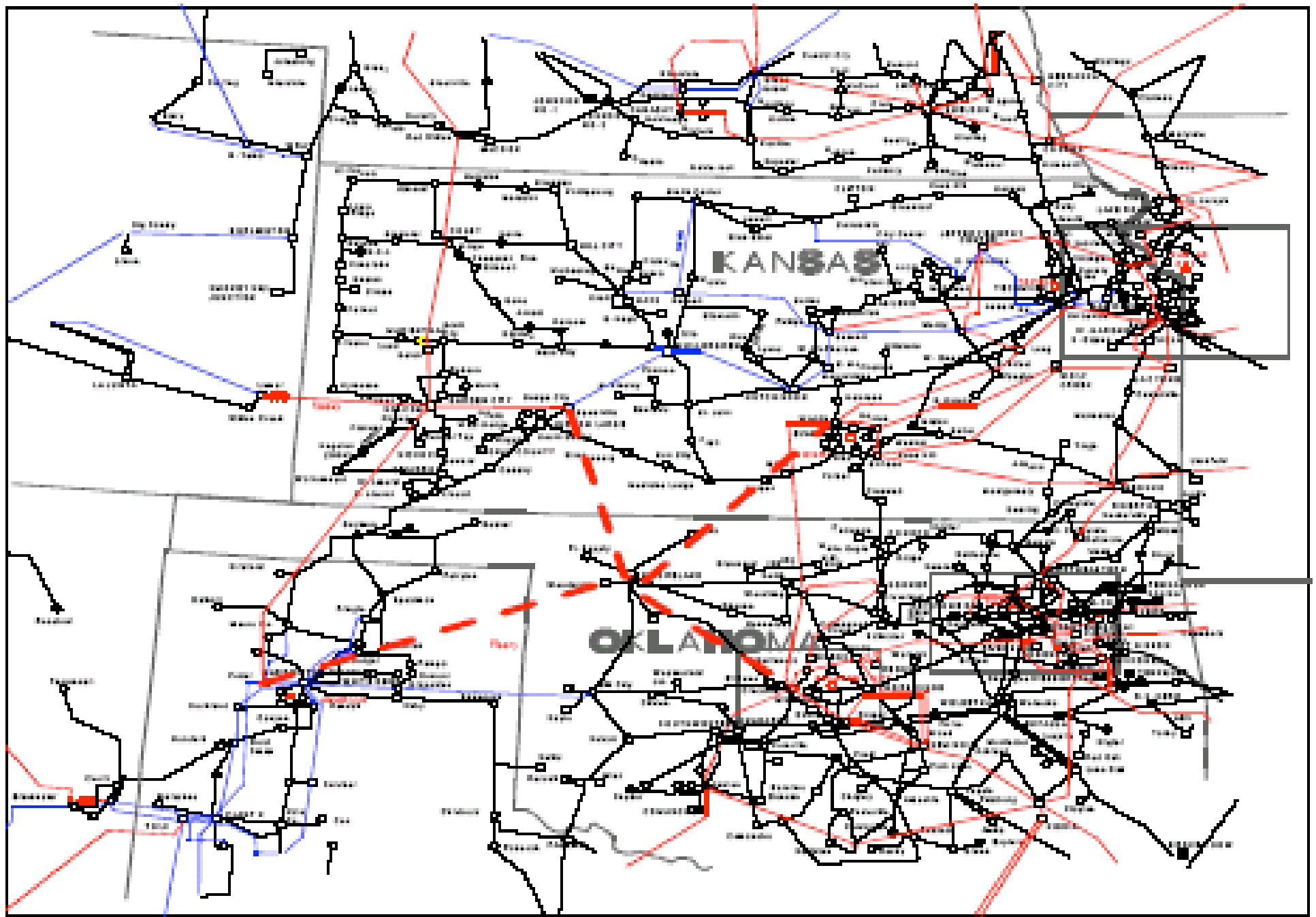
**Nebraska-Kansas-Oklahoma Alternative
(345 kV Expansion)**

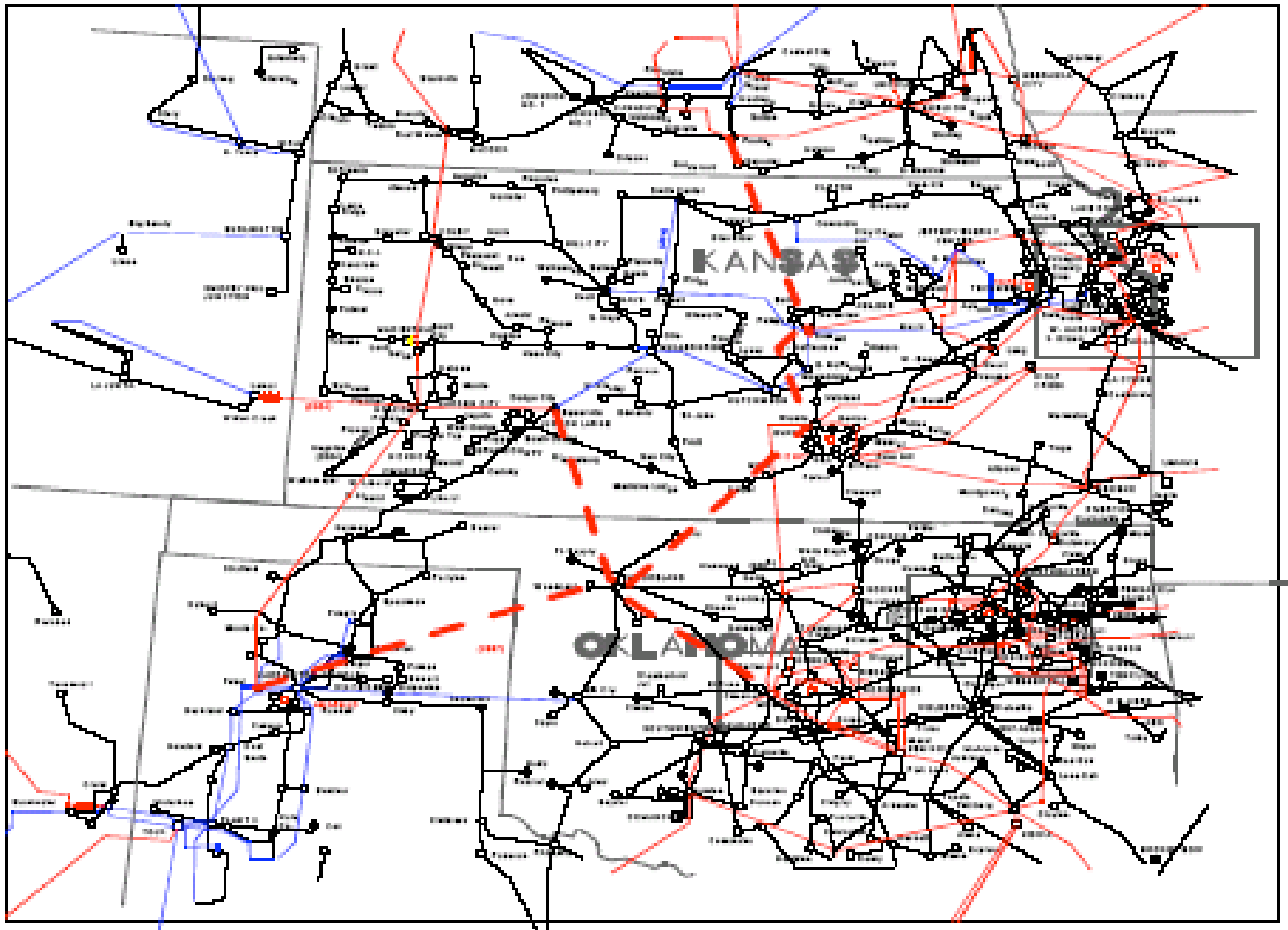


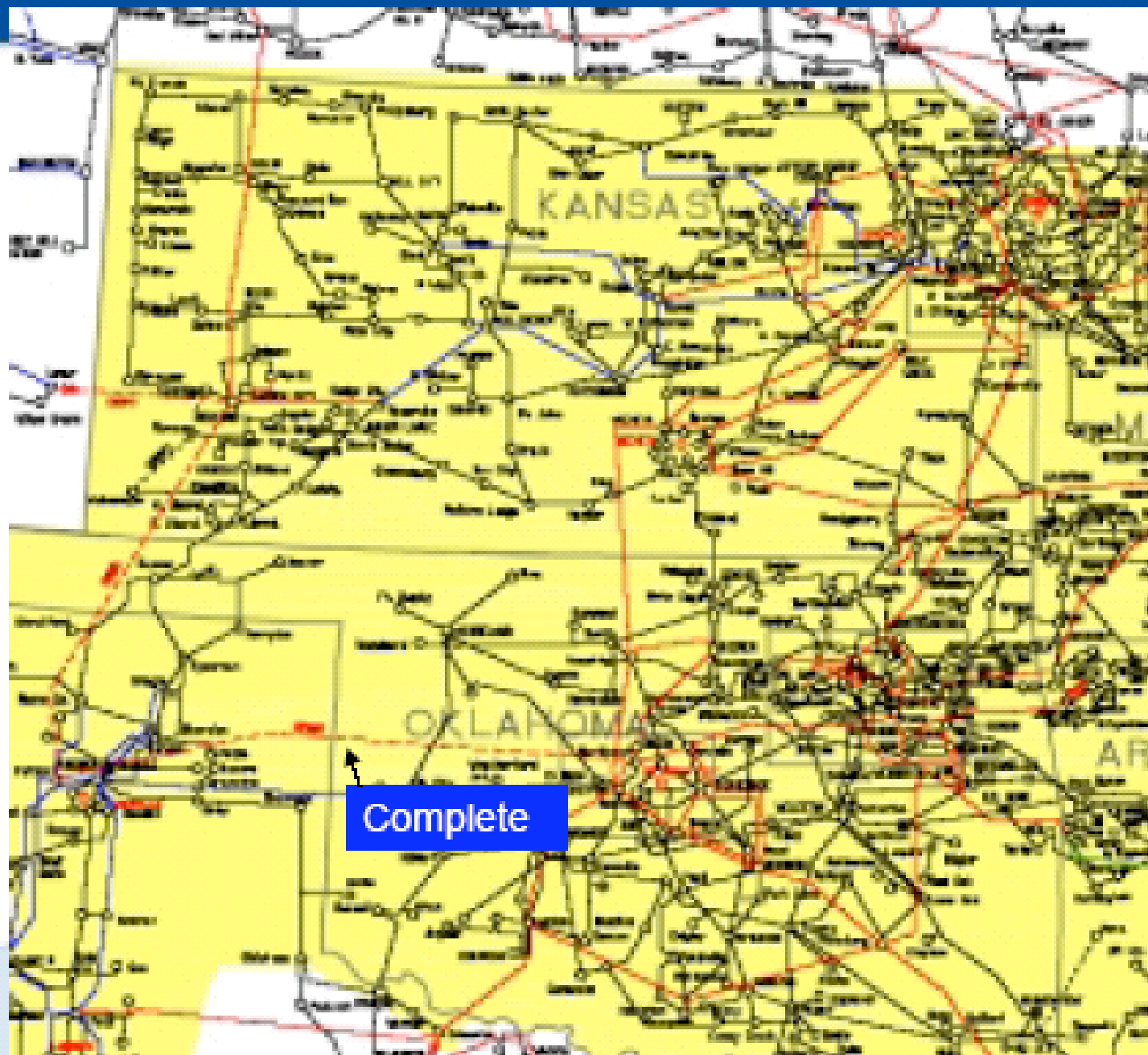
Nebraska-Kansas-Oklahoma Alternative (MISO 345 kV Expansion)









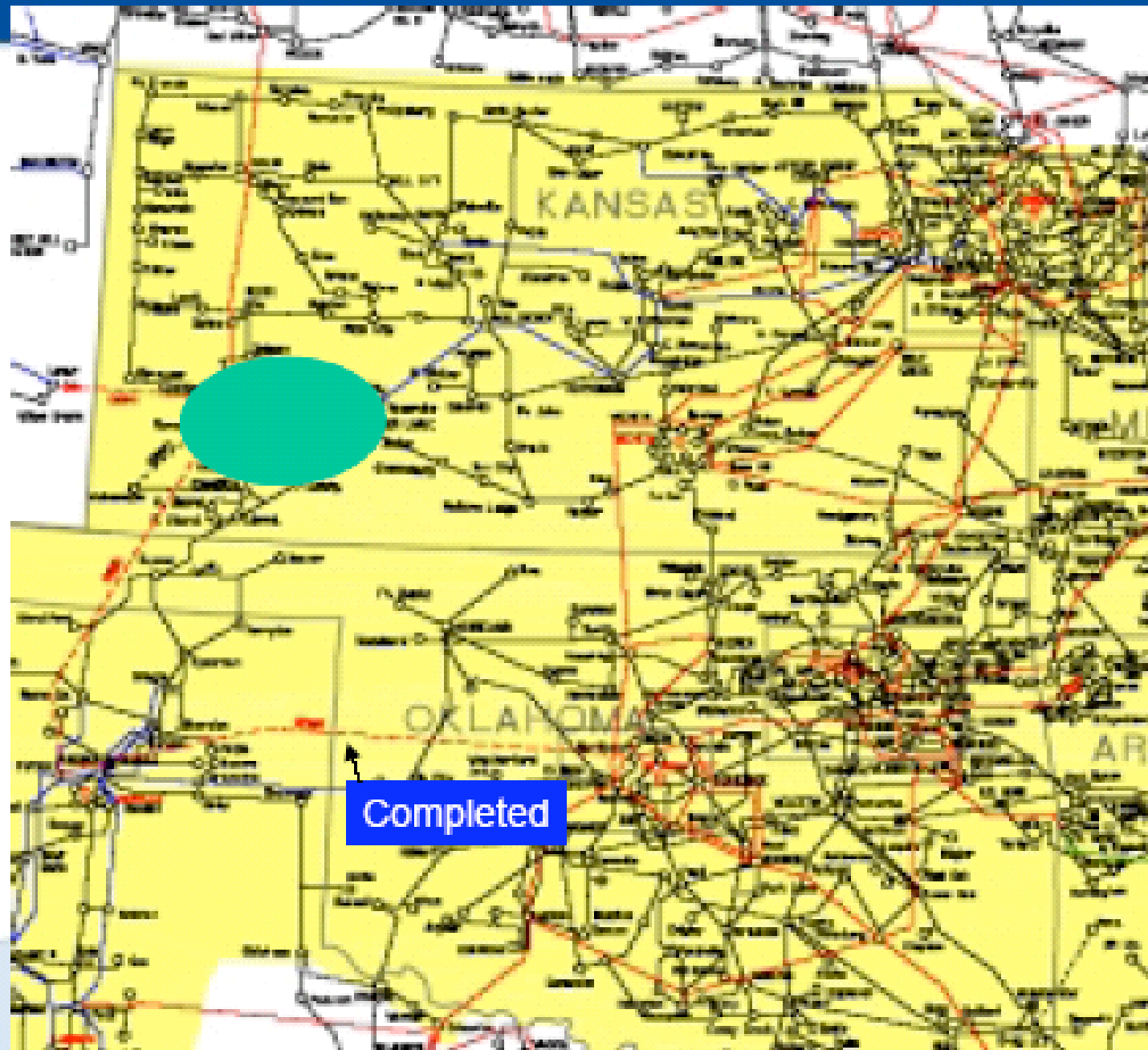


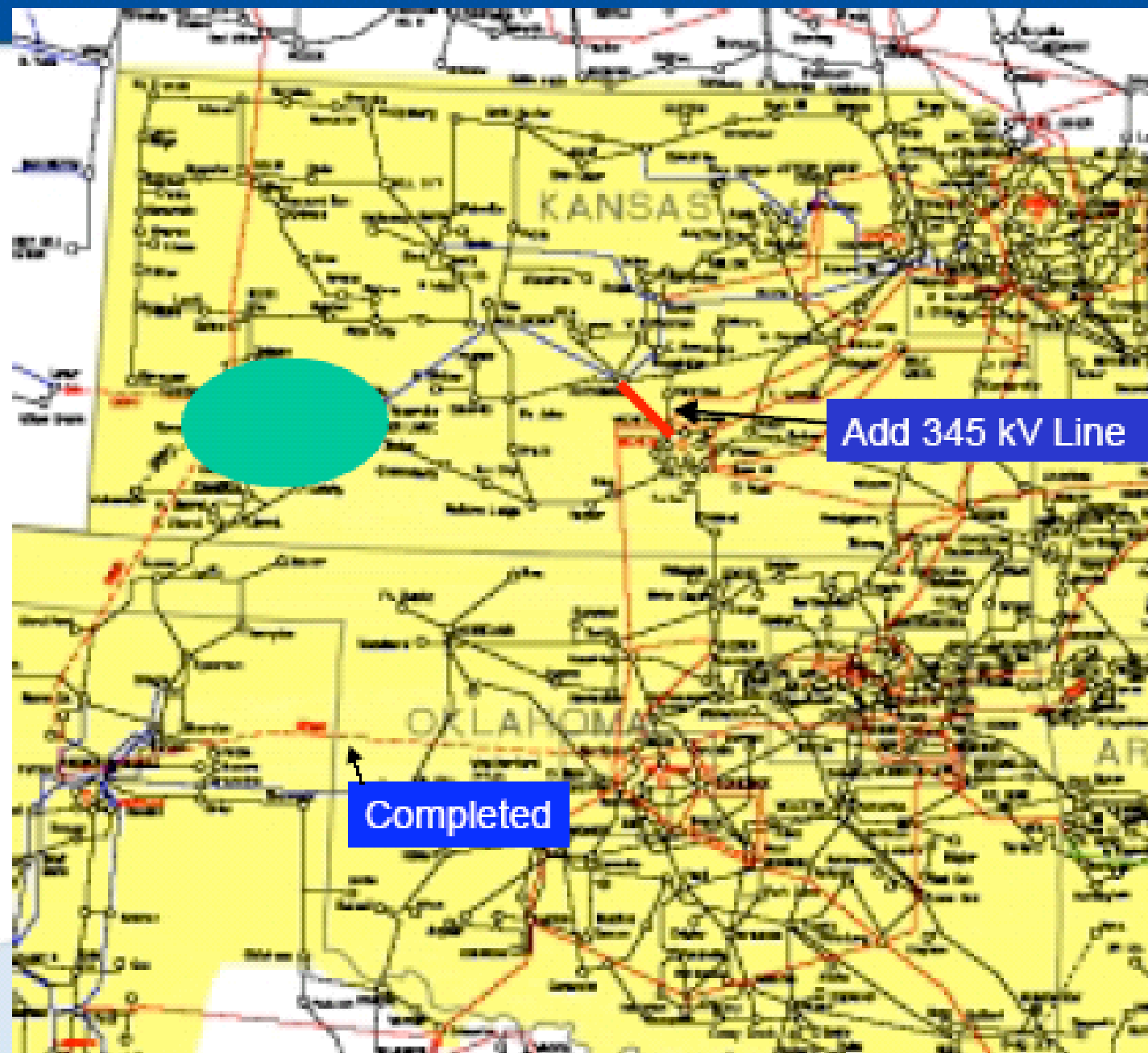
Major Improvement to PRESENT SYSTEM For Current Voltage, Stability, Capacity Constraints

(Complete Potter to Northwest 345 kV line)



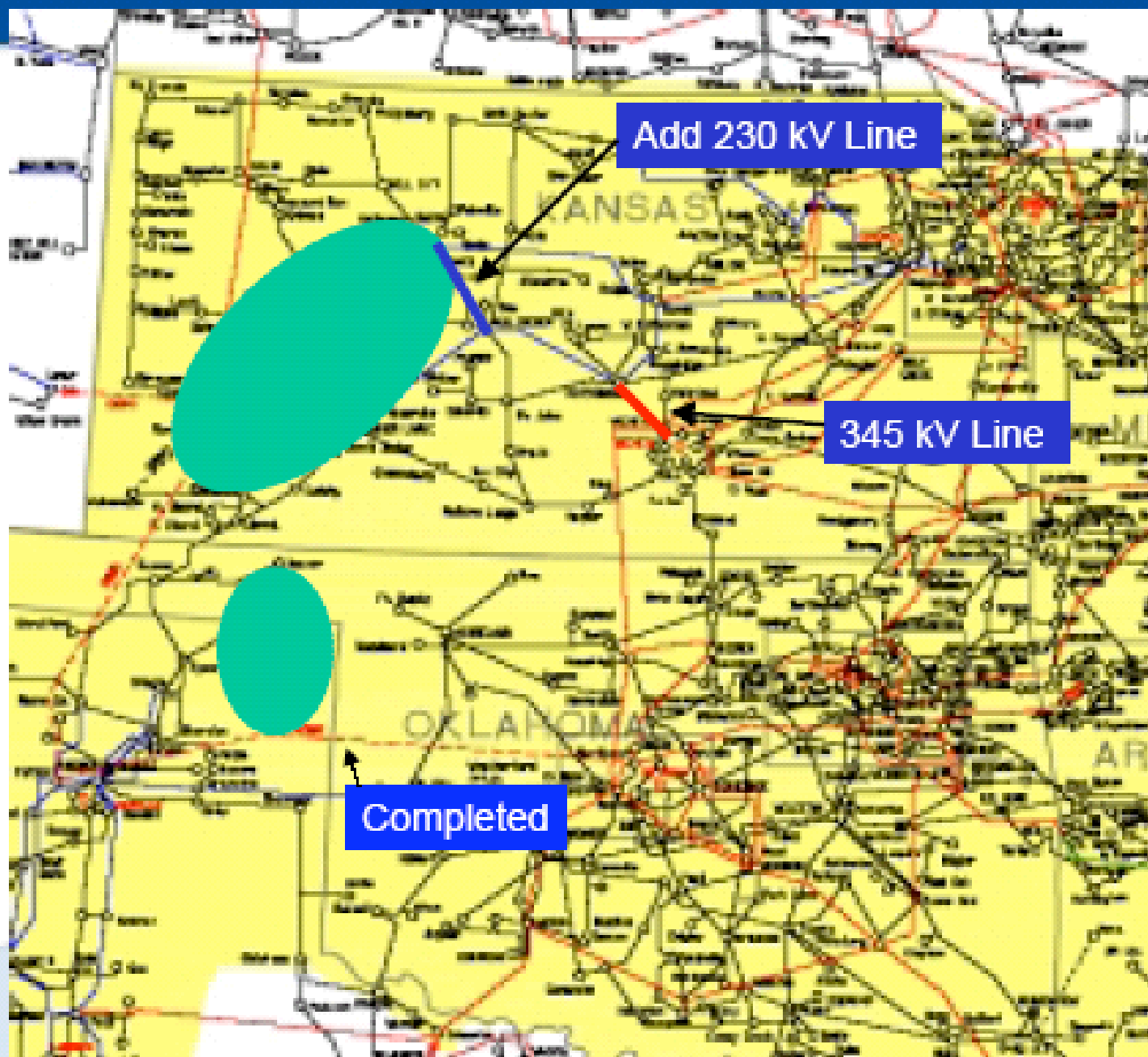
300 MW
Wind Power
Addition
to
PRESENT
SYSTEM
In Western
Kansas





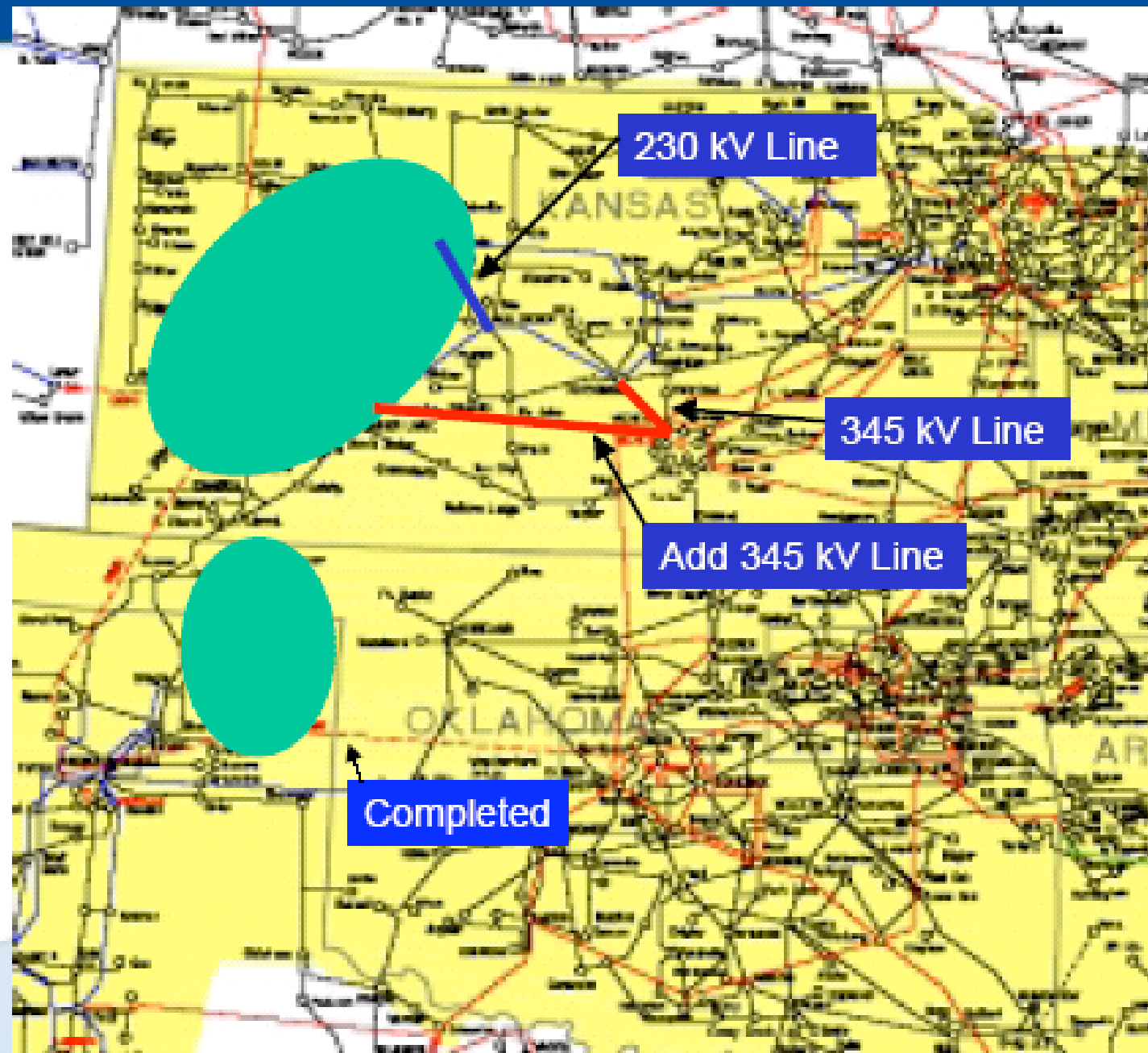
Major
Transmission
Addition to
Support
300 MW
Wind Power
Addition
to
PRESENT
SYSTEM
In Western
Kansas

(345 kV line
From
Hutchinson
(Circle 6)
To Wichita)



Major
Transmission
Addition to
Support
500 MW
Wind Power
Addition
to
PRESENT
SYSTEM
In Western
Kansas and
Texas

(230 kV line
from Knoll to
Mullergren)



Major
Transmission
Addition to
Support
1000 MW
Wind Power
Addition
to
UPGRADED
SYSTEM
In Western
Kansas,
Oklahoma
and
Texas

(Spearville to
Wichita
345 kV line)

Moderate Growth Cost Summary

New Wind	Suggested upgrades	Costs	Miles		
	*345 KV Potter-Northwest	\$81.85M	275		
	*345 kV Wolf Creek-Lang	\$24M	30		
300 MW	**345 KV Hutchison-Wichita	\$19M	30		
500 MW	***230 KV Mullergren-Knoll	\$20.6M	50		
1000 MW	****345 kV Spearville-Wichita	\$63M	120		

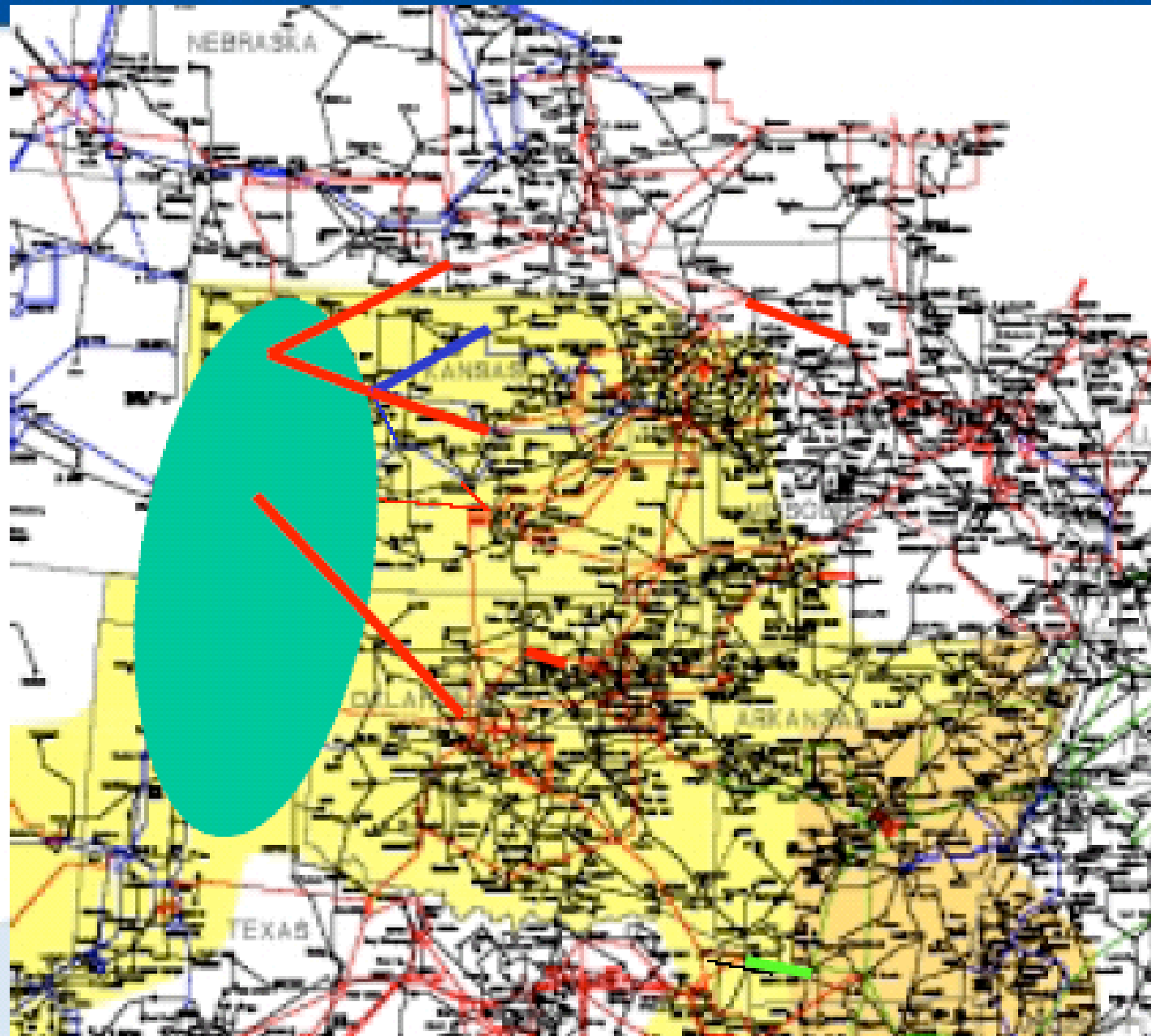
Notes:

*SPP number bulk phase 2 number

**Assumes \$500k/mile for construction + \$2M for transformer and \$2M for switchgear

***Assumes \$400k/mile + \$600k for switch gear

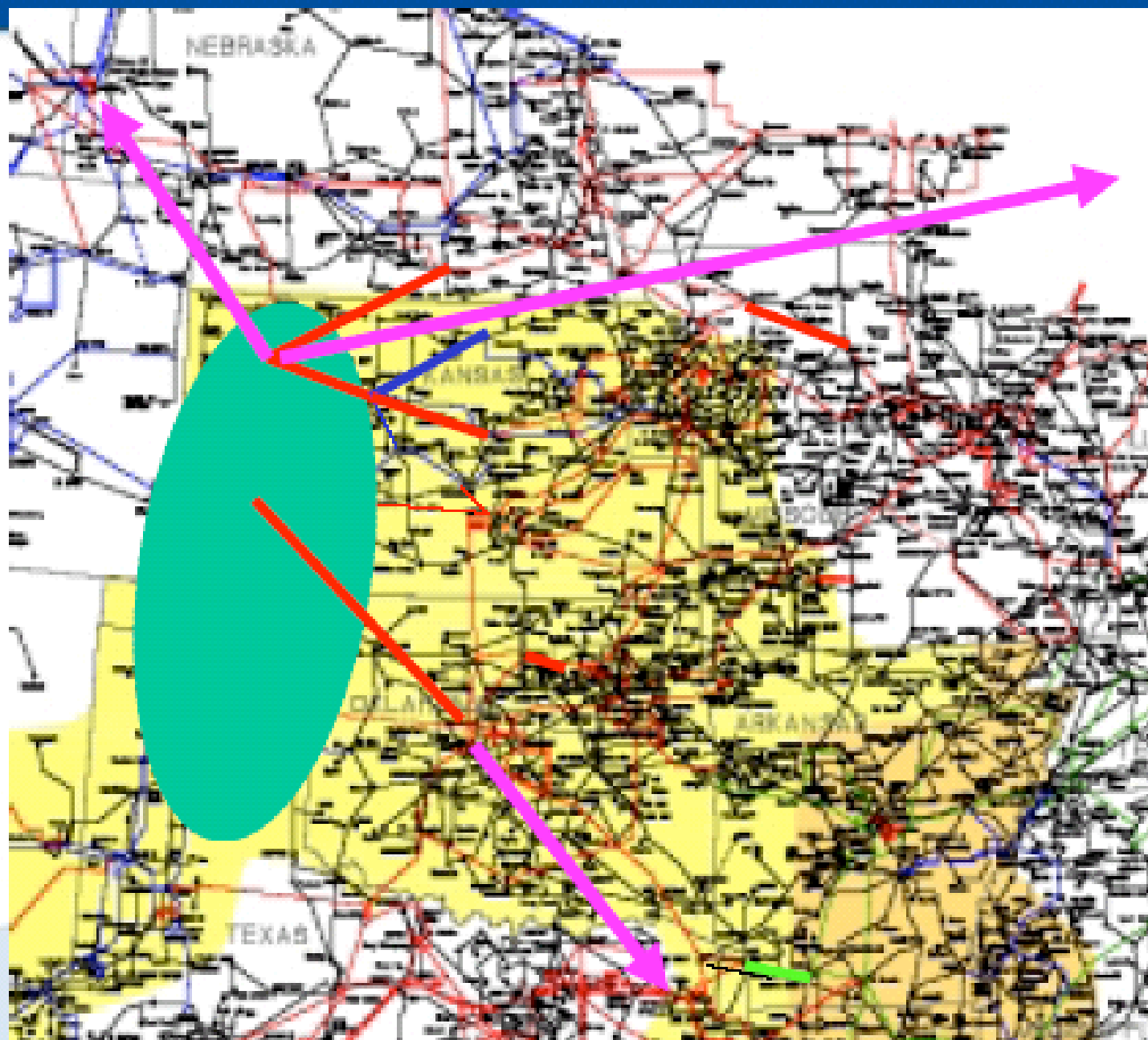
****Includes \$3M for switchgear



2000 MW
Wind Power
Development

Possible
AC Line
Addition
Choices





5000 MW
Wind Power
Development

Possible
DC and AC
Lines-
Additional
Choices
(DC Lines to
Denver,
Chicago,
Dallas)

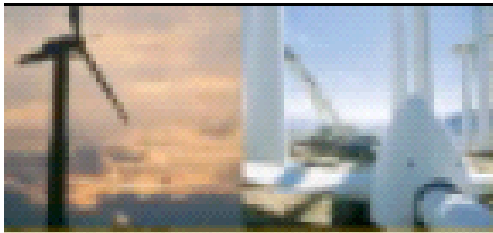
Aggressive Growth Cost Summary

New Wind	Suggested Upgrades	Costs	Miles			
2000 MW	345 kV Holcomb-Northwest	\$125M	250			
	345 kV Mingo-Knoll-Summit	\$100M	200			
	345 kV Mingo-Pauline	\$85M	170			
	230 kV Knoll-Concordia	\$50M	100			
	345 kV Sooner-Cleveland	\$10M	20			
	345 kV Fairport-Thomas Hill	\$50M	100			
	500 KV Texarkana-McNeil	\$22.5M	45			
5000 MW	*400 kV Mingo to Denver	\$96M	240			
	**500 kV Mingo to Chicago	\$304M	800			
	*400 kV Northwest to Dallas	\$93M	230			
Notes:						

2000 MW scenario does not include upgrade costs for transformers and switch gear

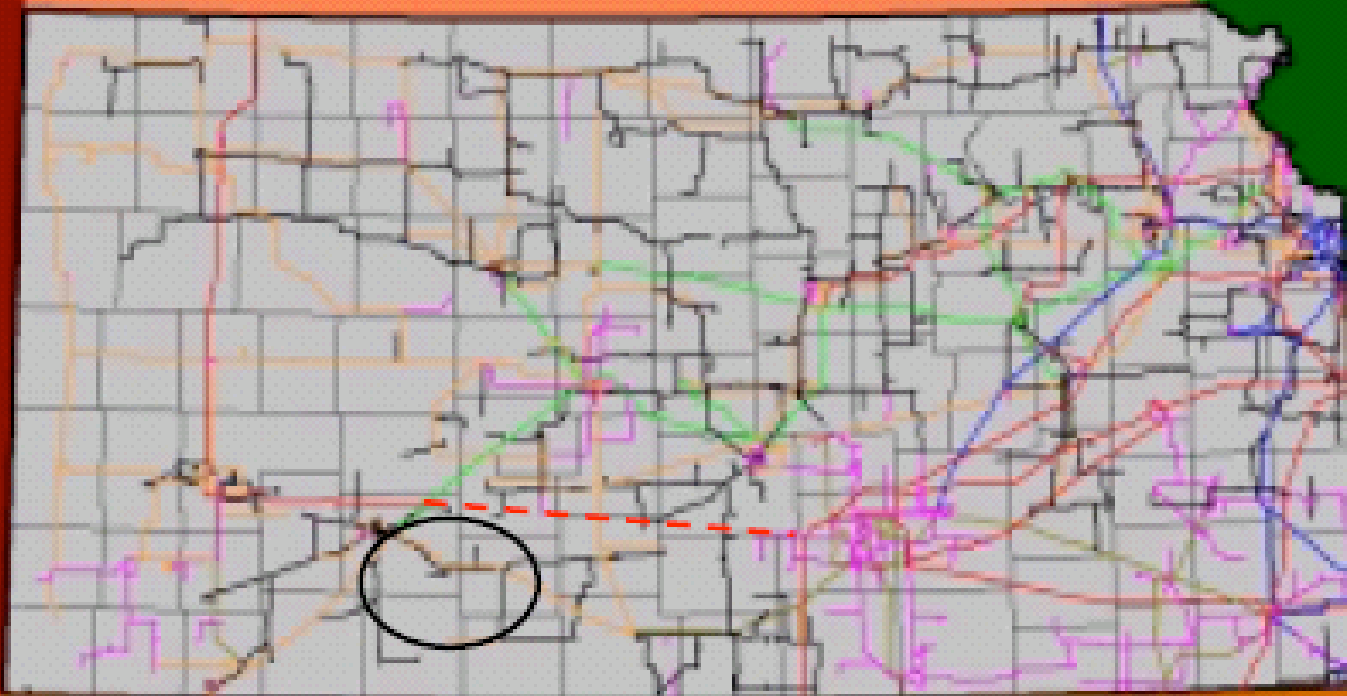
*Assumes cost of \$300k per mile for construction and \$24M for termination and AC converters

**Assumes \$350k per mile plus same termination and AC converter costs



Kansas Transmission

Opportunity to interconnect
Spearville to Wichita 345kV



Spearville Wind Power Project